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RIPENING PEARS IN FAN CARS AT THE TERMINAL MARKET

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Report of a study made under
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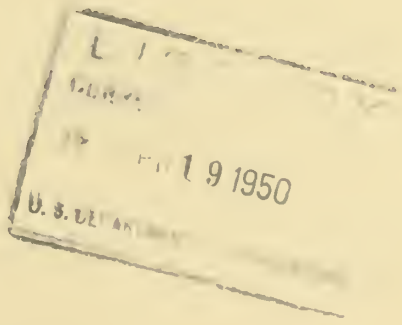
Project No. 552



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Ripening Pears in Fan Cars at the Terminal Market

This report summarizes the results of a second test 1/ made to determine whether carload lots of winter pears could effectively be ripened in fan cars after arrival at the terminal market. Should such a method prove feasible it would offer an alternative to the use of a ripening room after unloading and might be particularly applicable for smaller markets where such facilities are not available.

Car PFE-7451, equipped with Preco fans, wall flues, and with 3 to 3 1/2 inches of insulation was loaded at Medford, Oregon on November 30, 1949, with 768 standard boxes of Bosc pears. The boxes stowed on end, three layers high, eight rows wide, thirty-two stacks long, not stripped, constituted a standard "through load."

A set of twelve resistance thermometers was placed in the car at the time of loading so that temperature readings could be made whenever desired from outside the car while the doors were closed. Thermometer bulbs were inserted in pears in each of the eleven locations indicated in table 1. The twelfth bulb was used for obtaining air temperatures at the ceiling, quarterlength centerline position of the car. A Ryan thermograph was attached to the ceiling at quarterlength centerline position and another was placed under the floor racks at the bottom quarterlength centerline position. Outside air temperatures were recorded by a Ryan attached to the underside of the car.

Six test boxes were selected at the time of loading as representative of a uniform lot of fruit. One box was placed at each of the bottom, middle and top quarterlength centerline positions, one at the bottom doorway north side position and two were placed at the top doorway north side position. All test boxes except the two at the top doorway position contained resistance thermometer bulbs as described above.

The commodity temperature was 30° to 31° F. at the time of loading and averaged near 41° at arrival. Fruit temperatures were not taken during transit. Air temperatures recorded by the Ryan thermograph at the quarterlength centerline position during transit were generally in the range of 32° - 36° F. beneath the floor racks and 34° - 40° at the ceiling. The outside air temperature ranged mostly from 40° to 55° during the first six days of transit and below 32° during the last five days.

The car was placed at the New York City Harlem River Warehouse of the Atlantic and Pacific Tea Company early in the afternoon of December 12. One of the two test boxes at the top doorway north side was removed to the Market Pathology Laboratory and placed in a 65° F. ripening room, where pressure tests were made at daily intervals. The adjacent test box was left in the car and the pears used for checking pressures at intervals during the heating test.

A portable Preco electric motor was attached to the fan pulleys at each end of the car to operate the two car fans. Two thermostatically-controlled methyl-alcohol (Preco) heaters with the thermostats set for maximum heat (60° F.) were

1/ A report of a preliminary test made in January, 1949, is summarized in H. T. & S. Office Report No. 203.

placed in each bunker. The heaters were lighted at 5:00 p.m. after the fans had been in operation for a half hour. The fans and heaters were maintained in continuous operation for 60hours, after which all of the heaters were removed from the car. An exception is to be noted in that one heater in each bunker was extinguished six hours before the end of the heating test.

Temperature readings were made by means of the resistance thermometer equipment at intervals of four hours for the first 24 hours. Subsequent readings were made at 30, 36, 48 and 60 hours after the start of the test. At the time of each reading, air temperatures were taken manually at a point in the bottom bunker half way between the two heaters. At the same time the operating condition of the heaters was noted. Fuel consumption was determined 24, 48 and 60 hours after initiation of the test.

Following the completion of the heating period at 60 hours the vents were opened and the fans kept in operation for another 12 hours, after which the motors were removed. Vents were closed at 87 hours.

Fifty boxes of fruit were unloaded at 80 hours and the remainder at about 100 hours. At the time of final unloading the four test boxes that had remained undisturbed in the load were removed to the 65° F. room and ripened alongside the box removed at the start of the test.

Results

The temperature data obtained during the 60-hour car-heating period are presented in table 1. It will be noted that the air temperature at quarterlength centerline ceiling was continuously in the approximate range of 65° - 70° after 12 hours of heater operation. Floor-layer temperatures at the bunker reached 65° sometime between 36 and 48 hours. All fruit temperatures were 50° or higher at 16 hours, 60° or higher at 30 hours and 65° or higher 48 hours after lighting the heaters. By 60 hours most commodity temperatures were near 70° F. Fruit temperatures rose fairly uniformly throughout the load. The fruit in the exposed edges at the bulge did, however, warm up somewhat more rapidly than the fruit in the center of the boxes. A notable exception occurred at the edge of the bottom quarterlength centerline box.

The spread in temperature between the coldest and the warmest position decreased gradually from a maximum of 14 degrees at 12 and 16 hours to 4 degrees at 48 and 60 hours.

The temperature record for each center-of-box fruit position is shown diagrammatically in figure 1 and for each edge position (and the two air positions) in figure 2. The temperature records (where available) also are shown for the period extending between the end of the heating period (60 hours) and the time when unloading was completed (100 hours).

All heaters were full burning at each inspection (temperature reading) up to and including the one made at 16 hours. One heater in each bunker was found on pilot at the 20th hour inspection, three of the four heaters on pilot at the 24th hour inspection, and all on pilot thereafter. One heater in each bunker was extinguished at 54 hours. A total of 7.35 gallons of fuel was burned during the first 24 hours, 2.7 gallons during the second 24-hour period and 0.65 gallons during the last 12 hours, or a total of 10.7 gallons for the entire 60-hour period. The rate of fuel consumption per heater was calculated to be approximately .09 gallons per hour while the heater was full burning and one-fourth of that

rate while the heater was on pilot.

The weather was at first somewhat milder than usual for mid-December at New York, but turned cooler later. U. S. Weather Bureau temperature records for New York City for the period of the test follow:

Date	Maximum	Minimum	Mean
December 12	59°	44°	52°
" 13	60°	36°	48°
" 14	39°	32°	36°
" 15	36°	22°	31°
" 16	36°	23°	30°

The pears in the top doorway test box left in the car decreased in pressure from 11.3 to 9.3 pounds during the 60-hour heating period. The fruit in the other top doorway test box had a pressure of 10.4 pounds when removed from the car at the start of the heating test and daily pressures thereafter of 9.2, 10.3, 7.5, 5.3, 4.9 and 3.8 while held in a 65° F. ripening room.

Pressure test data are summarized below for the four other test boxes removed at final unloading and placed in a 65° ripening room 102 hours after the start of the car heating test.

Hours after beginning of the car-heating period	Pressure test of fruit removed to a 65° ripening room after final unloading.				
	BQLCL Box	MQLCL Box	TQLCL Box	BDWNS Box	Average 4 Boxes
Hours	Pounds	Pounds	Pounds	Pounds	Pounds
102	10.2	9.2	9.4	9.9	9.7
138	7.3	5.4	4.9	7.7	6.3
162	4.0	3.6	3.9	4.6	4.0

A summary of the ripening to fruit pressures of about 4 pounds is shown graphically in figure 3.

It will be noted that the fruit in the top doorway box removed from the car at the start of the heating period began to soften uniformly after approximately two days in the 65° F. room and reached 3.8 pounds four days later. The pears from the test boxes left in the car until the time of car unloading had softened only slightly prior to unloading but from then on, taken as an average lot, they softened uniformly to four pounds in two and one-half days. Their ripening was thus about two days behind that of the pears removed from the car and placed at 65 degrees in the ripening room at the start of the heating test. The ripening data are more or less in accord with the temperature data in view of the fact that the pears in the car required on the average about 36 hours of heating to reach a 65° temperature. Then, too, it should be held in mind that 16 hours after the heaters were removed (24 hours before final unloading) temperature of the fruit in the four test boxes had dropped below 65° and continued to 58.5° or below at time of removal from the car.

Discussion and Conclusions

The test has demonstrated the possibility of ripening winter pears in fan cars after arrival at the market. Operation of the car fans with two heaters burning in each bunker raised the average initial fruit temperature of 41° F. to approximately 65° in 36 hours and to nearly 70° in 60 hours. There was no evidence of overheating of the exposed fruit. Under the conditions of this test fruit temperatures of 65-70° F. were readily maintained for as long as desired after reaching that range - with very little consumption of fuel. This is indicated by the fact that during the last six hours of the test temperatures continued to rise slowly even though two heaters were extinguished and two were on pilot. The length of the heating period in commercial practice would be determined by the degree of ripening desired. 2/

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2/ For a discussion of the time required to ripen pears of different degrees of firmness the reader is referred to A. T. A. S. Office Report No. 212.

Table 1. - Temperatures Obtained with Resistance Thermometers During Heating Period (PFE-7451).

	Location 1/		Temperatures (° F.) After Specified Hours of Heating									
			Start	4 hrs.	8 hrs.	12 hrs.	16 hrs.	20 hrs.	24 hrs.	30 hrs.	36 hrs.	48 hrs.	60 hrs.
			Fruit temperatures										
1	BQCL	Center	43.0	44.5	47.0	50.0	53.5	56.5	59.5	62.5	65.0	68.5	71.1
2	"	Edge	39.5	43.5	47.0	50.5	54.0	56.0	58.5	61.0	63.0	66.0	68.5
3	MQCL	Center	41.0	42.5	44.5	48.0	51.5	54.5	58.0	61.0	63.5	66.5	69.5
4	"	Edge	42.0	48.5	53.0	57.5	61.0	62.5	63.5	65.5	66.5	69.0	71.0
5	TQCL	Center	41.5	43.5	47.0	51.0	55.0	58.5	61.0	64.0	65.5	68.0	70.0
6	"	Edge	42.5	50.5	55.5	60.0	64.0	64.0	65.0	66.0	67.0	69.0	70.5
7	BDNS	Center	38.5	40.5	43.5	48.0	52.0	55.5	58.5	61.5	63.0	65.5	67.5
8	TDCL	Center	40.5	42.0	45.5	49.0	53.0	56.5	59.5	62.0	64.0	67.0	69.5
9	TDNS	Center	40.5	43.0	46.5	50.0	54.0	57.5	60.0	63.0	65.0	68.0	70.0
10	MDNS	Center	38.0	39.5	43.5	46.0	50.0	53.5	57.0	60.0	62.0	65.0	67.0
11	MDBE	Edge	41.5	48.0	54.0	58.5	62.0	63.0	64.5	66.0	66.5	68.0	70.5
12	Avg. of all Centers		40.5	42.2	45.8	48.9	52.7	56.1	59.1	62.0	64.0	66.8	69.7
13	Avg. of all Edge		41.2	47.0	52.6	56.4	60.3	61.4	62.9	64.6	65.8	68.3	70.2
			Air Temperatures										
14	TQCL at ceiling		47.0	56.0	60.5	64.5	62.0	56.0	65.5	66.5	67.5	69.5	70.5
15	Bunker - at CL floor		-	47.5	51.5	55.5	57.5	60.5	62.0	63.0	64.0	66.5	67.5

1/ Box location in load: B = bottom layer, M = middle layer, T = top layer, Q = quarterlength, D = doorway, CL = centerline, NS = north side.

Location of near container resistance thermometer: Center of box, Edge of box at bulge.

Nos. 1 - 11: Temperatures taken with resistance thermometer.

Nos. 12 - 15: Temperatures taken manually in each bunker at three levels midway between heaters; each figure represents an average of both bunkers.

positions from start of heating test to final unloading.

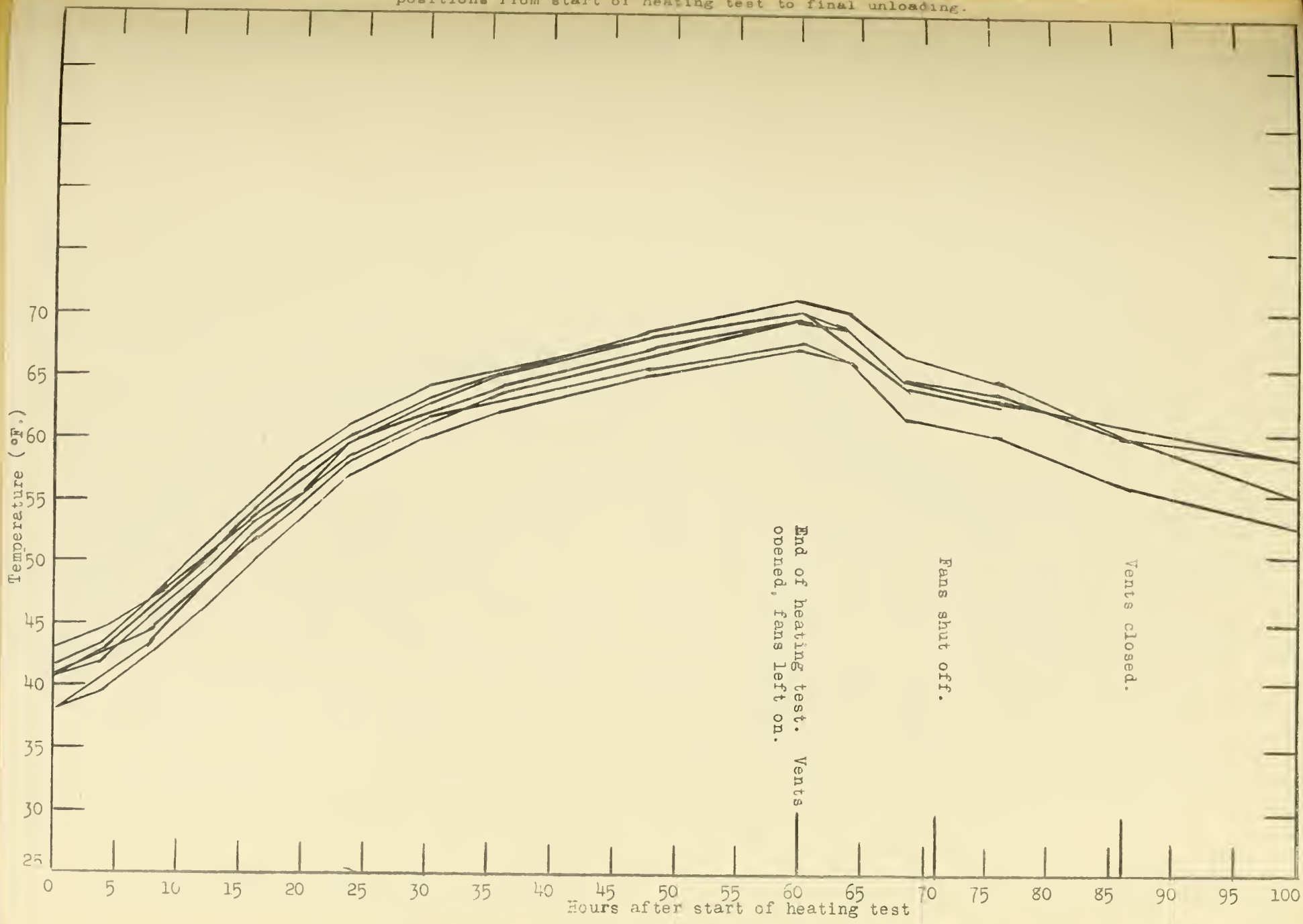

Figure 7 - Fruit temperatures at four edge-of-box positions and air temperatures at two positions from start of heating test to final unloading.

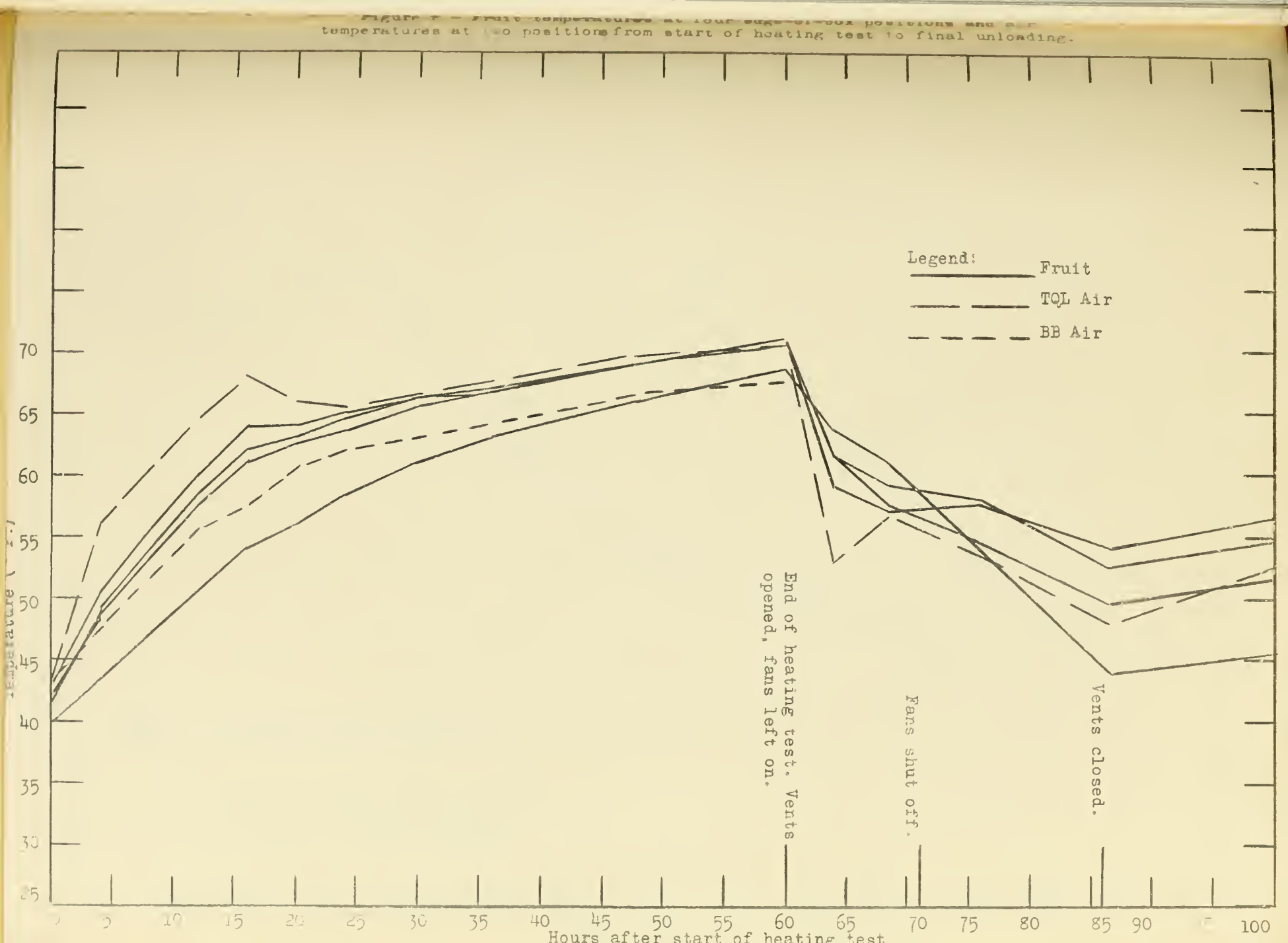
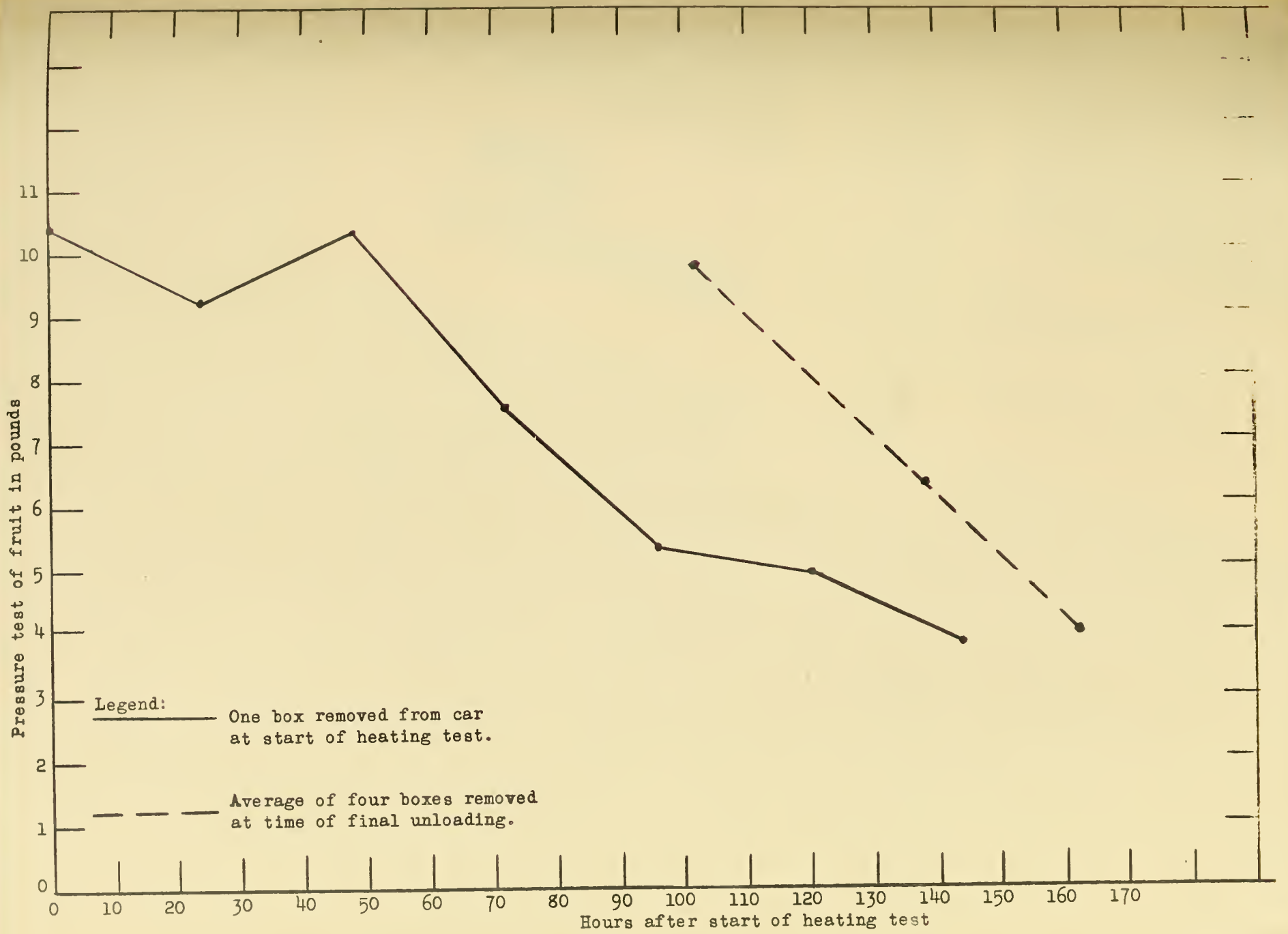
Figure 3 - Ripening of pears in test packages held in 65° F. room.